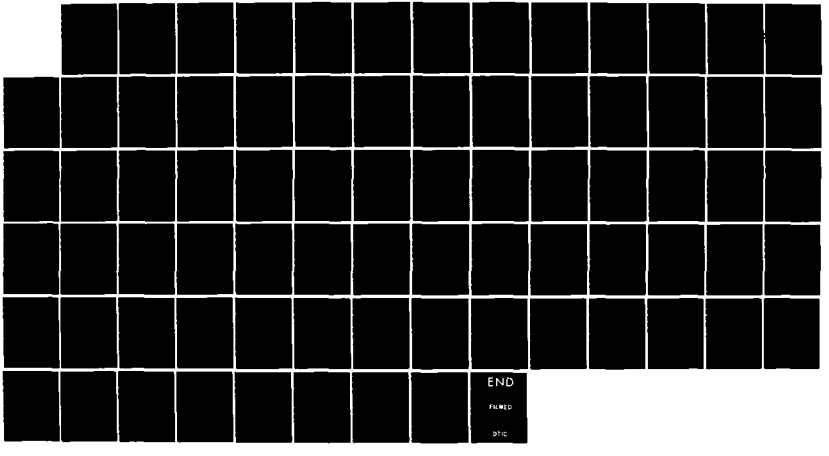
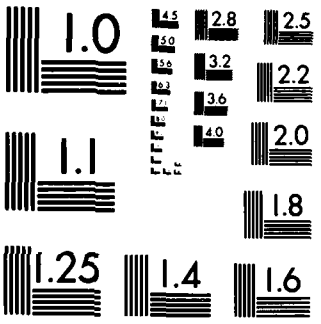
AD-A151 181 THE ENGINEERS WHO HAVE LEFT DCA (DEFENSE COMMUNICATIONS AGENCY): THEIR MOTIVATIONS AND ASPIRATIONS(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA C M SHERMAN JUN 84 1/1

UNCLASSIFIED F/G 5/9 NL





NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE ENGINEERS WHO HAVE LEFT DCA:
THEIR MOTIVATIONS AND ASPIRATIONS

by

Colleen M. Sherman

June 1984

Thesis Advisor: R. Evered

Approved for public release; distribution unlimited

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. A151101	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The Engineers Who Have Left DCA: Their Motivations and Aspirations		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; June 1984
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Colleen M. Sherman		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		12. REPORT DATE June 1984
		13. NUMBER OF PAGES 75
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Turnover; engineer, scientist, motivation, Defense Communications Agency, management, research and development, retention

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This ~~research~~ study attempts to answer two questions: what are the reasons behind turnover among engineers at the Defense Communications Agency (DCA) and what attracts and motivates DCA's engineers. Interviews with engineers who left DCA between January, 1981 and February, 1984 showed that they are overall individuals who: have a strong, primary need to do professional, challenging technical work that is also important work; and to perform the work in a professional environment

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Block 20 Contd.

where appreciation of their work is communicated to them by competent management. They are drawn to a particular job largely by the nature of the work it offers. The opportunity to have a positive personal impact is another attractor variable, as is the opportunity to grow professionally and technically. The motivation to seek a new job can come from the perception that one is dead-ended professionally or has no more opportunity to grow technically. For the majority, salary is at most a secondary consideration in deciding to leave a job. Engineers may also be induced to leave a challenging, significant job if matters external to the work process itself become intolerable or highly frustrating, and a position of equal or greater merit is available elsewhere.

Approved for public release; distribution unlimited.

The Engineers Who Have Left DCA: Their Motivations and Aspirations

by

Colleen M. Sherman

B.S., Boston University, 1970

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1984

Author: Colleen M. Sherman

Approved by: Roger D. Evered
Thesis Advisor

Reuben T Harris
Second Reader

Willis R. Greer, Jr.
Chairman, Department of Administrative Sciences

Kneale T. Marshall
Dean of Information and Policy Sciences

ABSTRACT

This research attempts to answer two questions: what are the reasons behind turnover among engineers at the Defense Communications Agency (DCA) and what attracts and motivates DCA's engineers. Interviews with engineers who left DCA between January, 1981 and February, 1984 showed that they are overall individuals who: have a strong, primary need to do professional, challenging technical work that is also important work; and to perform the work in a professional environment where appreciation of their work is communicated to them by competent management. They are drawn to a particular job largely by the nature of the work it offers. The opportunity to have a positive personal impact is another attractor variable, as is the opportunity to grow professionally and technically. The motivation to seek a new job can come from the perception that one is dead-ended professionally or has no more opportunity to grow technically. For the majority, salary is at most a secondary consideration in deciding to leave a job. Engineers may also be induced to leave a challenging, significant job if matters external to the work process itself become intolerable or highly frustrating, and a position of equal or greater merit is available elsewhere.

TABLE OF CONTENTS

I. INTRODUCTION 8
A. A LOOK AT DCA, A HIGH-TECH EMPLOYER 8
B. THE COMPETITION 10
C. DCA AS A COMPETITOR 11
D. THE QUESTIONS TO BE ANSWERED 12

II. SURVEY OF THE LITERATURE 13
A. AN OVERVIEW 13
B. SCIENTISTS AND ENGINEERS: SOME POSITIVE AND NEGATIVE MOTIVATORS 14
C. WHAT OTHERS HAVE TO SAY 16
D. SUMMING UP THE LITERATURE 22
E. A COMMENT ON SCIENTISTS IN THE BUREAUCRACY 23

III. METHOD 25

IV. THE RESULTS 28
A. THE ATTRACTOR OR MOTIVATING VARIABLES 28
1. What About DCA Draws Engineers to Work There? 28
2. What Does a Great Job Look Like for an Engineer? 31
3. What Engineers Really Liked About DCA . . 32
B. A PORTRAIT OF THE IDEAL SUPERVISOR OF ENGINEERS 33
C. EXPECTATIONS OF VERSUS EXPERIENCES AT DCA IN SEVEN KEY AREAS 34
D. THE PERCEIVED REALITIES OF WORKING WITH DCA SUPERVISORS 35

1. Relationships with Supervisors 35
2. How Well Did Your Supervisor Perform in the Supervisory Roles? 36
3. What About The Level of Supervision? . . . 37
4. Could the Employee Influence His Supervisor? 37
5. Relationship With Supervisor and Quitting DCA. 38
6. The Engineer and the Powers That Be . . . 38
E. TOP MANAGEMENT AND THE QUIT RATE 39
F. PEER RELATIONSHIPS 40
G. HOW ABOUT YOUR PROFESSIONAL DEVELOPMENT? . . 41
H. SPACE AND EQUIPMENT 42
I. PAY LEVEL AND LEVEL OF EARNING POTENTIAL REALIZED 42
J. RECOGNITION ON-THE-JOB 44
K. THE MOST FRUSTRATING THINGS ON THE JOB AT DCA 45
L. WAS THE GRASS IN FACT GREENER? 48
V. SUMMARY AND CONCLUSIONS 49
A. ATTEMPT TO ADDRESS THE TOTAL MOTIVATIONS PACKAGE 49
B. DCA'S DRAWING CARDS 51
C. THE NEGATIVES FOR SOME DCA ENGINEERS 51
D. THE IDEAL JOB 52
APPENDIX A: INTERVIEWER'S GUIDE 54
APPENDIX B: INTERVIEW RESPONSE LISTINGS 60
LIST OF REFERENCES 70
BIBLIOGRAPHY 72
INITIAL DISTRIBUTION LIST 73

LIST OF TABLES

1. THE ATTRACTOR VARIABLES 29
2. DEGREE TO WHICH INITIAL JOB EXPECTATIONS WERE MET AT DCA 35
3. RATING RELATIONSHIP WITH THE SUPERVISOR 36
4. SUPERVISORY PERFORMANCE 36
5. THE LEVEL OF SUPERVISION 37
6. ABILITY TO INFLUENCE THE SUPERVISOR? 38
7. ABILITY TO INFLUENCE THE POWER PERSON? 38
8. HIGH LEVEL LEADERSHIP INFLUENCE YOUR QUITTING DCA? 39
9. RELATIONSHIP WITH COLLEAGUES 40
10. EVALUATE YOUR PROFESSIONAL DEVELOPMENT 41
11. WAS RECOGNITION ADEQUATE? 44
12. HOW IMPORTANT IS RECOGNITION? 45

I. INTRODUCTION

With the advent of sophisticated electronic weapons systems, and the rapid advancements in space and telecommunications technologies, the sophisticated scientist and engineer become a resource critical to a successful national defense strategy. The Defense Communications Agency (DCA) is deeply entrenched in one segment of the Department of Defense's (DoD's) high technology (high-tech) business.

A. A LOCK AT DCA, A HIGH-TECH EMPLOYER

DCA is responsible for the design, management, evaluation and evolution of the DoD's worldwide Defense Communications System (DCS). The worldwide DCS is made up of all of the DoD's long haul, point to point communications networks, such as the Autovon telephone system, and the Defense Digital (automated data) Network, and all of their component subsystems: the Defense Communications Satellite System (DSCS), various power systems, transmission systems, operations centers, and much more. The DCS is a 40 billion dollar telecommunications "plant," approximately, which must be interoperable with U.S. commercial systems and with the military and commercial tele- communications systems of allied nations. It must be highly survivable in terms of enemy attack or attempts at sabotage. It must be and remain state-of-the-art in character. Engineers at DCA plan, design, and oversee the system's evolution to twenty years in the future, as well as manage it in its present state.

This writer's hope, at this point, is that readers will begin to appreciate DCA's need for many, very sophisticated telecommunications systems engineers. In fact, one highly

respected director of a key segment of DCA's engineering resources once remarked that, in his opinion, it took about ten years to "build" an engineer who could do DCA's required systems-level engineering in a thoroughly knowledgeable manner.

Unplanned turnover among engineers, then, is a very costly thing to DCA. This is not solely in terms of dollars when it can take up to ten years to acquire broad and thorough worldwide systems expertise, and many years to reach varying points of intermediate expertise. Unplanned turnover, then, has a potentially serious impact on the quality and character of the engineering DCA is capable of; and has a potentially significant impact on the quality of decisions that are made about the present and future state of the worldwide DCS.

Over the last three years, DCA management has become concerned over the loss of numbers of highly valued engineers, many of whom were senior systems engineers -- perhaps the agency's most valuable resource. The numbers of engineers leaving DCA may not appear to be alarming in terms of absolute magnitude. Thirty-two of an approximate population of 256 civilian engineers (or 12.5%) voluntarily separated from DCA between January 1, 1981 and the time of this study, February 11, 1984. This rate does not compare unfavorably with that of the private sector. The concern at DCA is that these engineers are difficult and costly to replace; the learning curve at DCA is considerable. Further, the number leaving could be on an upward trend. The number of engineers voluntarily separating from DCA increased by 62.5% between 1981 and 1982. The 1983 figure was a somewhat lower increase over the 1981 figure: 37.5%.

E. THE COMPETITION

In its May, 1981 report, the American Electronics Association projected a 78% growth rate for the 1981 - 1985 period, as a percentage of 1980 employment, for electronic/electrical engineers [Ref. 25: pp.41-45]. The final results on this projection are not yet in. However, there is no doubt at all that the electronics industry is in a considerable growth period. Over 90% of DCA's engineers fall into this electronic/electrical category. The same study projected manpower shortages in this category through 1985 (the study limit) [Ref. 25: pp. 41-45].

Other studies predict that the electronic/electrical engineering supply will approximate or very slightly exceed the demand during this time frame [Ref. 6: pp. 31-39].

For a look at the supply side of this labor coin, we turn our attention to remarks made in January of 1983, by Catholic University President Rev. William J. Byron, S.J., testifying before Congress on behalf of the American Council on Education. Byron warned that, "There are serious shortages of qualified mathematics and science teachers. During the 1970's the number of secondary school mathematics teachers being trained declined 77%; science teachers being trained declined 65%." He further warned that, "At least 2,000 vacant faculty positions exist in university engineering departments." [Ref. 26: p. 7] The Scientific Manpower Commission confirms Byron's position saying that: "The faculty shortage has developed because industry has recruited most of the graduates at the bachelor's level, leaving relatively few to go on to graduate school and prepare for teaching. Additionally, engineers already on university faculties have been lured away by higher salaries and better equipment for research in industry, and by increased teaching loads and fewer graduate assistants in

academe. During 1979-80, almost 400 full-time engineering faculty (2.7% of all permanent engineering faculty) voluntarily left adademia for full-time employment in industry. In some cases, the salaries of doctoral engineers in private industry are nearly double those of engineering professors. The shortage of engineering professors is expected to get worse and the quality of instruction to continue to degrade." [Ref. 26: p. 7]

The competition for engineers is stiff - and there is every indication that growth in demand will continue while higher education falls deeper into the throws of serious problems as the engineer supplier.

C. DCA AS A COMPETITOR

The Defense Communications Agency has some particular handicaps as a competitor in this employment market. Government salaries for engineers of this type generally run from about 15% to 35% below the market rate at present. In a 1983 report by the Scientific Manpower Commission, 1982 salary data showed that Federal entry level salaries for engineers with a B.S. degree and no work experience ran from 31% to 38.5% below salaries offered by industry. For various levels of mid-level engineers, Federal salaries were 19% to 23% low. For senior engineers, and engineering supervisor and management levels, the salary differential was from 14% to 26% low. [Ref. 11: pp. 13-14] The pay discrepancy is higher yet for senior engineering executives. As of this writing, there is no relief in sight for this salary situation in the Federal community.

Until recently, as results of this research will show, the appeal of the breadth and challenge of the work available to engineers at DCA has permitted its viable competition in this unfavorable market. However, that appeal seems

III. METHOD

This research has two goals: to learn what constitutes a satisfying job for an engineer, and to learn the reasons behind the engineering turnover that has occurred at DCA since January of 1981. To this end, as many of the group of engineers who voluntarily left DCA between January 1, 1981 and February, 1984, who could be located, and who were willing to be interviewed, were interviewed. To permit the development of rich data, members of the group were interviewed by phone rather than surveyed by mail. The interviews generally lasted between 30 minutes and 90 minutes.

Of the 32 who voluntarily left during the sample period, 20 were both located and available for interview. The attitude of the interview candidates toward the research project and their role in it was cooperative and positive in all but two cases among the 22 potential respondents who were located.

The thirty questions asked during the interviews were developed as a result of a review of the literature on related subjects: the motivation of engineers and scientists; the the management of engineers and scientists; the conditions for creativity; the management of research and development professionals; the development of commitment among professional staff. The results of similar empirical studies of motivation and retention issues among federally employed engineers and scientists were also considered.

The interview questions finally developed focused on discovering:

- what factors drew these engineers to DCA initially and what they may have enjoyed about working at their various jobs at DCA

risks and be allowed to fail; people who are bright and able, with good, marketable skills, and who respond with sensitivity to the fallibilities environment in which they work? I speculate that the potential for incompatibility is great. At this time, I cannot guess at the magnitude of the problem. I do know, however, that a significant number of fine scientists do choose the Federal service at some point in their careers, and produce stellar work: at NASA, at the National Institutes of Health, at the Defense Advanced Research Projects Agency, at the Naval Reserach Lab, at DCA and elsewhere. It's an interesting puzzle..., another good topic for further study.

environment in which a competent superior's recognition of the significance of the work is communicated to the engineer or scientist.

The engineer and scientist look for these key elements in jobs they consider undertaking. They leave jobs in which the conditions which permit and foster this environment are compromised to a degree which they find significant. However, the scientist or engineer may also be induced to leave an environment in which matters directly related to the work are agreeable if externalities of significance to him or her become intolerable and a position of seemingly equal technical merit is available elsewhere.

E. A COMMENT ON SCIENTISTS IN THE BUREAUCRACY

Haga's Law is an entertaining, yet sobering look at the bureaucracy. In it, the authors make the point that we are preoccupied, as a business culture, with controlling uncertainty. "Organizations always go too far. Observing how well a little arranging and standardizing can reduce uncertainty, people in new organizations are invariably driven to systematize still more. Once the fall begins, the decline is swift." They hammer home the point that the norm is to control events and outcomes; to standardize; "Life is more organized this year than it was last year. It will be still more so next year...Humanity's disdain for bureaucratic systems is surpassed only by its horror of events it cannot control - yet uncertainty remains constant." [Ref. 3: pp. 20, 25]

The Federal work culture is the supreme bureaucracy. How does this insistence on control and predictability impact the work situations of Federally employed scientists and engineers - people who need autonomy, yet recognition; people who need "space," yet support; people who must take

"simultaneous loose - tight properties." Speaking of excellent organizations they say, "For the most part, as we have said, they have pushed autonomy down to the shop floor or product development team. On the other hand, they are fanatic centralists around the few core values they hold dear." [Ref. 5: p. 15]

Again as seen elsewhere, the authors stress the deliberate use of rewards and their importance in companies with an excellent track record: "...We are creatures of our environment, very sensitive to external rewards and punishment." [Ref. 5: p. 56] And then, "The systems in the excellent companies are not only designed to produce lots of winners; they are constructed to celebrate the winning once it occurs. Their systems make extraordinary use of nonmonetary incentives. They are full of hoopla." [Ref. 5: p. 58] Considering the topic or rewards, of positive reenforcement of some significance, the authors go on to apply Skinner's findings on the subject of reenforcement to the management arena. They add that, "Our general observation is that most managers know very little about the value of positive reenforcement." [Ref. 5: p. 70] They sum up the philosophy of excellent companies as follows: "The excellent companies have a deeply ingrained philosophy that says, in effect, 'respect the individual,' 'make people winners,' 'let them stand out,' 'treat people as adults.'" [Ref. 5: p. 277]

D. SUMMING UP THE LITERATURE

Scientists and engineers are clearly: men and women who have a strong and very primary need to do highly professional, challenging, technical work; to do this in environment that allows them to perceive that they are doing something that counts, that is of significant import and impact; and to do this in a professional environment, and an

less motivated than their predecessors, but are more likely to become demotivated by what they see and experience than any work group before them." [Ref. 19: p. 356] I cannot judge the degree to which one generation becomes more easily demotivated than another. However, as affluence spreads into all realms of our society, it seems reasonable to assume that the needs of man, "the wanting animal," as McGregor describes him, would have moved up into the higher plains of the needs structure. Since ego satisfaction and self actualization are more personal, more emotionally-dependant than the needs of prior generations concerned with survival, it wouldn't surprise me to find empirical support for Peterfreund's claim.

If popularity and general public acceptance are any measure of validity, the support for claims about the new breed is in Peters' and Waterman's recent best seller, In Search of Excellence. "We desperately need meaning in our lives and will sacrifice a great deal to institutions that will provide meaning for us. We simultaneously need independence, to feel as though we are in charge of our destinies, and to have the ability to stick out...(we need) at one and the same time to be a member of a winning team and to be a star in his own right."

There is much in In Search of Excellence that reaffirms assertions in the literature we have surveyed. Since a significant portion of their research was conducted in "high tech" companies, I include some of their findings here.

The authors emphasize the need for autonomy and the encouragement of risk-taking, as we have seen elsewhere: "The innovative companies... don't try to hold everyone on so short a rein that he can't be creative. They encourage practical risk-taking and support good tries." [Ref. 5: p. 14] Without calling it such, Peters and Waterman put forth the notion of "creative tension." They refer to

happy rat" tenet: keep the rewards coming; select talent that generate their own excitement; make him or her feel good; hedonism - be aware that people seek pleasure and avoid pain; make the recognition of performance very visible; create change, for variety, but not too fast. [Ref. 17: p. 13] Various arguments are advanced by the authors to support these premises and exhortations. Although the arguments are not developed as scientifically as they might be, there really is quite some compatibility with other findings reviewed herein: nourish the scientists ego; be aware of things in the work environment which might cause frustration and discomfort. [Ref. 17: p. 14]

Manners et al mention another factor seen often in the literature: the one who manages scientists and engineers must encourage his or her staff to take risks, must offer some protection in the case that the individual fails. They note that the notion of "protection" further implies a concern for the personal dignity of the scientist. "Respect and dignity are precursors to the generation of work excitement," they add. At the same time, the authors caution that incremental rewards should only be associated with success. "This is a difficult balancing act requiring a significant amount of self-discipline on the part of the manager." [Ref. 17: p.14] Here we see yet another concern introduced into the complex equation for motivating and retaining scientists: timely rewards are essential as is protection from risk associated with innovation; yet unsuccessful innovation must not appear to be rewarded incrementally. Finally, the authors note, as did Mr. Wortman, that "the capacity to motivate is dependent upon managerial credibility." [Ref. 17: p. 16]

There are yet many other interesting tenets in this area of thought. Peterfreund, writing in the decade of the seventies speaks about "the new breed...They come to work no

Pelz and Andrews add yet another interesting dimension to understanding engineers and scientists at work. That is the concept of "creative tension." They postulate that a force like autonomy (representing challenge) is counterbalanced by a force like job security (representing stability) in environments where scientists can be most effective. "It seemed reasonable to say that the scientists and engineers of our study were more effective when they experienced a 'creative tension ' between sources of stability or security on one hand and sources of disruption or challenge on the other. This term was suggested by T.S. Kuhn in a paper entitled, 'The Essential Tension: Tradition and Innovation in Scientific Research.'" [Ref. 4: pp. xv] The following is among the illustrations Pelz and Andrews give of this concept: "Scientists place a high priority on freedom...As stated by Anne Roe, 'Almost all studies of scientists agree that the need for autonomy, for independence of action, is something particularly strong in this group.' In what seemed an inconsistency, however, effective scientists did not avoid other people; they and thier colleagues interacted vigorously...In our speculative framework, independence or self-reliance is a source of security. Interaction is a source of challenge, for they may criticize and prod. The high contributor experienced a creative tension between independence and interaction." [Ref. 4: pp. xix-xx]

Thus Pelz and Andrews approach the generally accepted higher order of needs satisfaction of scientists from yet another vantage point - not contradicting what others have written or suggested, but adding yet another dimension, or perhaps application.

There are a host of additional opinions on what the key ingredients in the motivation of scientists and engineers are. Manners, Steiger and Zimmerer talk about the "fat

Wortman, then, in a deductive approach, accepts that the engineer and scientist have motivations dealing with the ego and self-actualization, and goes on to suggest specific things a manager can do to create conditions in which the ego is nourished, and self-actualization is encouraged. In fact, a good portion of his book consists in various inventories of leadership style and personality which the manager/reader is encouraged to apply to him-or-herself. Wortman then assists the reader in interpreting his results, and contrasting these with the leadership demands for successful management of scientific and engineering personnel. His focus is not on a detailed look at the needs, likes and dislikes of scientists; rather he generally describes the broad psychological nature of these people at work, suggests means of meeting needs they have, and and attempts to assist managers to recognize the appropriate leadership style for scientists and engineers and contrast it with their own - an important work, I think.

Providing the manager/reader with more good food for thought, Wortman outlines McClelland's thinking on power, affiliation and achievement as primary motivators. He does some insightful work illustrating the way responses and need manifestations might differ among scientists whose primary motivation differed among the three McClelland offers, and suggests how a manager might be alert to and respond effectively to these varying need structures.

Finally, Wortman gives considerable attention to the art of managing conflict, for he postulates that, "It is not often recognized that the people who cause conflict may be the truly creative members of the staff." He also develops the idea that managers' tendency to learn and use effective means of suppressing conflict can be truly counterproductive in the scientific environment - another worthwhile postulate, and one which the writer of this paper recommends for further development.

Let's turn to another student of the motivations of engineers and scientists. Leon Wortman, a management consultant specializing in the high tech arena, once a practicing engineer himself, finds these dimensions key to the engineer and scientist: a reward system related to the attainment of specific objectives; emphasis given to the individual's performance rather than that of the group; a goal-setting procedure that enables each individual to participate in the setting of his own quantified goals in accordance with those of the organization; rapid feedback on performance and immediate rewards for successful task fulfillment and relative independence for the individual from other segments of the organization. [Ref. 2: 39-40]

What are some of the factors behind Wortman's different approach to defining the proper environment for the scientists?

Early in his book, Wortman makes this statement: "Psychologists generally agree that the creative person is characterized as self-stimulating, independent, sensitive, goal-oriented, and capable of giving direction to his own efforts...It would also seem that such people's motivations are operant at the high level of Maslow's hierarchy of needs." [Ref. 2: 63-64]. Shortly after, he follows it with this statement: "The function of the engineering manager, director of R & D, vice president for engineering - or whatever the manager's title might be - is not to show the creative engineer how to perform his function. It is primarily to create the ambience and the relationship that motivates, stimulates the creative process of the individual who is responsible for the work task." He also adds, "It almost goes without saying that engineers and scientists, especially those who are identified as creative, must have positive regard for the professional skills and knowledge of their managers in reference (not deference) to the technological areas in which they operate." [Ref. 2: pp. 65-66]

attractive features of his environment." [Ref. 12: p. 201] Their findings clearly showed that, "Among the prime satisfiers that serve to attract the scientist toward his organization are his interest in his work and his technical freedom." [Ref. 12: p.206]

It is of significant note that in this study both the statistical frequencies associated with the negative motivators and those associated with the positive or attractor variables were significant beyond the .001 level.

C. WHAT OTHERS HAVE TO SAY

Following is a survey of other highlights of the literature around the motivation to work as it pertains to engineers and scientists.

The pendulum of literary opinion takes a wide swing in the subject of the work motivations of scientists and engineers. At one end of the spectrum, Earl B. French considers: the engineers desire to be responsive to family needs and demands; his or her need to do meaningful, challenging scientific work; the desire for wealth and convenience; the desire for recognition in in the scientific community; the desire for an optimal work environment etc., and finds these motivations so complex and full of conflict that he concludes his essay saying, "If the motivation of scientists and engineers is viewed in this light, it could well be that motivating them to higher performance is largely beyond the control of research and development management." [Ref. 14: p.155]

There is something of a point in Mr. French's statement: it is a complex issue. However he misses a key point: knowing the nature of what attracts scientists to work and what discourages or frustrates them equips a manager to stack the odds of motivational success and of retention success in his favor.

about and the reasons for leaving one's last organization were not the negative of the reasons for entering the Federal service. Eight of the ten reasons for leaving, and all of the reasons for disliking the last position were related to job context as opposed to the work process, or to its intrinsic nature. [Ref. 12: p. 195]

In short, "The elements which attract a scientist to remain with an organization are not necessarily those that will precipitate his departure... Differing responses representing differing parts of the scientist's motivational structure are revealed through his answers to the varied questions posed to him." [Ref. 12: p. 196]

These findings are in line with fundamental research and reconfirm the need for at least a two-pronged approach to motivation, i.e., a la Hertzberg. R.L. Khan, in a review of Hertzberg's work said, "...perhaps the single most important finding from this work is that satisfaction and dissatisfaction on the job are caused by different factors, rather that by varying amounts of the same factors." [Ref. 15: pp. 9-10].

Friedlander and Walton go on to make this important, but perhaps not well understood point: "Thus, studies concerned with only job satisfiers reveal, at most only half of the motivational structure of scientists. Since these motivations depict the relative attraction of the scientist toward his job elements, they describe approach needs on his part and are thus positive motivations. Similarly, job elements important to the scientists dissatisfaction concern his repulsion away from these elements; these depict his avoidance needs and are negative motivations." [Ref. 12: p. 197] The authors draw this further conclusion; "Therefore whether one considers all of the main reasons, or merely job-related reasons, the predominant positive motivation of the scientist is toward the work process rather than toward any

B. SCIENTISTS AND ENGINEERS: SOME POSITIVE AND NEGATIVE MOTIVATORS

In a study of 82 scientists and engineers in the Federal service, Friedlander and Walton discovered that a scientist's reasons for remaining with his organization are quite different from (and not merely opposite to) those that might cause him to leave. Reasons which caused scientists to leave their positions were primarily related to work context, to factors peripheral to the work itself. Reasons which attracted the scientist to the organization and led him or her to stay were primarily related to work content, to factors related to work processes. "Reasons to stay are involved with the centrality of the work process in which there is intrinsic involvement by the scientist." [Ref. 12: p. 201]

Reasons the scientist left his last government position, on the other hand, and things he or she disliked in the last job look quite different. The authors said the following of negative motivations, those which cause a scientist to leave a job: "The scientist's reasons are concerned almost entirely with elements in his work context or in its community environment, rather than in the work process itself. " The top ten reasons given for leaving the organization were: deterioration of the technical program; promotion ceiling; desire for home ownership; poor housing; if superior disliked performance; the desire for higher pay; poor top management and leadership; an attractive college teaching offer; loss of technical freedom. Reasons for disliking the last position, as opposed to reasons for leaving, were dissatisfaction with administration and 'housekeeping' functions, with incompetent and inconsiderate supervision and co-workers, and with the administration of the technical programs. It seems clear, then, that the elements disliked

II. SURVEY OF THE LITERATURE

What do we know about creative individuals, engineers or scientists, about how they think, about their values, about why they work, where and at what they work? What do we know about what motivates the engineer or scientist? What do we know about his particular frustrations or intolerances at the workplace?

Following is a survey of current thinking about the work motivations of scientists and engineers. The literature search which preceded and continued throughout this study was undertaken toward the ends of developing relevant questions for the interview portion of this research, and gaining understanding of issues pertinent to the interpretation and categorization of the results of the interviews. Therefore, the literature review which follows is not critical in nature.

A. AN OVERVIEW

In brief, a review of the current thinking on the needs and motivations of scientists and engineers shows that their primary work needs and motivations relove around the challenge and interest of the work itself. They are professionals who thrive in a a dynamic professional atmosphere and are attracted to companies that appear to offer a stimulating technical and professional opportunity. However, reasons for leaving a job are not merely the opposites of the drawing factors, and they warrant some scrutiny.

Highlights of a representative sample of the literature follow.

to be in jeopardy for a significant number of DCA's engineers today. This trend, in combination with the prospect of ever stiffer competition for qualified engineer resources, make the subject of engineering manpower a critical one for DCA today.

D. THE QUESTIONS TO BE ANSWERED

The purpose of this research is two-fold: to find out why engineers who voluntarily separated from DCA between January 1, 1981, and February 11, 1984 did so; and to learn what motivates these engineers at the workplace, and what brings them contentment there. The steps to accomplishing these purposes included interviewing a sample of former DCA engineers.

This research only attempts to understand the reasons that these valued employees left DCA, and to learn what constitutes a satisfying job and work environment for them. Therefore, subsequent work to devise remedies for the problems uncovered is called for as a logical follow-on to this research.

The research presented is organized into 7 parts. This introduction is followed by: a survey of the highlights of pertinent literature, with emphasis on the needs and motivations of scientists and engineers; a description of and rationale for the methodology used to conduct this research; a presentation of the data collected, analysis of these findings; the research summary and conclusions; and appendices.

-what they felt that the characteristics of an ideal engineering job would be

-how they perceived their relationships with supervisors and managers in their chain of command, and how they assessed the skills and leadership performance of their supervisors and managers

-what they believed that the characteristics of an ideal supervisor of engineers would be

-how they felt about their relationship with colleagues both in their immediate work group and in interdependent work groups

-how they viewed their professional development during their DCA tenure

-how they felt about recognition, pay, benefits, office space and equipment

-what most frustrated them about working at DCA

-why they left DCA; and what, if anything, DCA could have done to influence them to stay.

In Chapter 4, the data from the interviews is aggregated and presented, usually, in the forms of raw numbers of respondents giving that answer, and percentage of respondents so answering. Slightly different treatments of data are used where respondents were permitted to give multiple responses, e.g., where respondents listed several traits about their work at DCA that they liked. In Chapter 5, Conclusions and Recommendations, major trends and other observations significant to DCA's desire to begin to exert some measure of control over engineering motivation and turnover are presented.

Although the engineers subject of this study include only engineers who have left DCA, it is quite plausible that their opinions are representative of the overall group of DCA engineering employees for a couple of reasons. The group of engineers subject of this study are varied in age and length of service - with as little as two years or as much as twenty years of service; and their responses to the interview questions were quite in line with those the literature would suggest that engineers would have.

It is the writer's recommendation that at some point in the near future, correlation studies be run between various demographic data elements, e.g., the respondents length of service, and responses or response patterns to questions. At the time of this printing, the necessary demographic data was not available.

IV. THE RESULTS

The results of the interviews with former DCA engineering employees are presented in this chapter along with an analysis of what the data indicate. The analysis includes highlighting significant trends and observations particularly as they may be useful to DCA. A listing of the actual responses to selected questions is at Appendix B (partial sentences from this writer's handwritten notes.) The response to these questions are singled out for delineation in an appendix because of their potential to add valuable interpretive data to the aggregate responses presented below. Where such potential does not exist, the questions are omitted from the appendix. An ordered listing of the full group of questions asked the 20 interviewees, in the order in which they were asked, is at Appendix A.

A. THE ATTRACTOR OR MOTIVATING VARIABLES

Questions 1, 4, 5, 6, and 12 are a series of questions intended to probe into the nature and particulars of positive motivators - attractor variables - for the engineer and his work in general, and for the DCA engineer and his work in particular.

1. What About DCA Draws Engineers to Work There?

The respondents were permitted to give multiple answers to the first interview question, "What drew you to DCA?" Several trends emerged. Seventy-four percent (74%) of the respondents were drawn to DCA by the nature of the work offered them. One hundred percent (100%) who came to DCA voluntarily (all but one of this sample of 20) mentioned

TABLE 1

THE ATTRACTOR VARIABLES

	% RESPONDING
DRAWING FACTORS	
Nature cf Work (challenging/exciting)	74%
Opportunity to grcw technically/professionally	53%
Professional atmcsphere/ respected colleagues	20%
THE IDEAL JOB	
Nature cf Work challenging/exciting/ variety/scope	85%
Have an impact/make a difference	70%
Professional Environment	30%
Advancement Opportunity	25%
Opportunity to Grcw technically/professionally	20%
WHAT WAS GOOD AT DCA	
Nature of the Work	70%
Opportunity to have an Impact/ Make a difference	20%
Degree of engineering freedom/ independence	20%
People	15%

the nature of work as an attractor variable and said that the work offered to them by DCA appeared to be challenging, interesting, state-of-the-art and/or exciting. (1)

The second most frequent response on the attractor factors DCA initially held for these engineers was a perceived opportunity to grow technically and/or professionally as engineers, systems engineers, in an engineering

---

[1]One of the 20 respondents came to DCA via transfer of function. his responses are included in all but this first question.

subspecialty, or in a few cases, as managers of large engineering projects or programs: 10 of 19 (53%) gave such responses.

In third place, these responses got two votes each: the professional atmosphere, and the opportunity to work with respected professionals for a total of 20% of respondents drawn to DCA anticipating a positive professional environment. We will see in section 'C.' of this chapter 45% of the respondents, the professional environment at DCA did not live up to the degree of professionalism that they expected to find at DCA when they arrived.

Two responses tied for fourth place among DCA's attractor factors with a vote of 15% each (3 respondents each). That tie was between an opportunity for advancement (positionally or monetarily) and the opportunity to "have an impact," to "make a difference" in engineering work that the subject found to be of significance or importance.

In relation to the "opportunity to advance" responses, it is important to note also that all respondents indicated that such opportunity alone was not in itself enough reason either to take or to leave a job. The nature of the work itself had to be "right" from their personal perspectives. (The engineers' views on what constitutes work that is satisfying are presented in the next section.) That respondents cared that the work they were doing was of some particular importance, was in fulfillment of some significant need for others, perhaps for a significant segment of society, was a recurring under-theme throughout the interviews. These responses got two votes each: a professional atmosphere, and the opportunity to work with respected professionals.

2. What Does a Great Job Look Like for an Engineer?

The next questions in this series were numbers four and five: "In general, what elements would be found in a satisfying job for you?" and "Of those elements found in a satisfying job for you, which are numbers one and two in importance to you?" Consistent with responses to the earlier question in this group, 17 of 20 (85%) mentioned the nature of the work to be performed as a primary element. The number one response among those related to the nature of the work was that the job needed to encompass challenging, stimulating and/or exciting work. Thirteen of 20 (65%) of the respondents selected challenging or stimulating-type work as the most important factor in a satisfying job, and another 3 placed it as a "close second," for a total of 80% of the respondents.

Eleven of 20 respondents (55%) "the opportunity to make a difference," or "to have an impact" as the the next most frequent response. One additional respondent saw it as a close second to job challenge. Two additional respondents gave a closely what could be considered a related response: "an environment in which one's work is appreciated and accepted." This grouping of related responses totals up to 70% or 14 of the 20 participants. In fact all of the respondents chose either matters related to the nature of the work or the opportunity to have a positive personal impact as either the first or second most important element in a satisfying job.

Six individuals, or 30%, spoke of the importance of a professional environment. Relationships with superiors, personal and professional respect for and from superiors, and respect for and among peers were often mentioned in the context of elements of a professional environment. Without referring to the idea of a professional environment, two

additional respondents similarly mentioned good relationships with management as a key element in a satisfying job, and one additional mentioned good relationships among co-workers.

Five of 20 (25%) chose responses related to career advancement and promotion making it the fourth most frequent type of response. Four more (20%) spoke of the opportunity to grow technically or professionally without specifically relating that objective to the notion of a promotion. If we group these sets of responses related to professional and/or positional growth, we see that 9 individuals, or 45%, answered in this general category.

3. What Engineers Really Liked About DCA

The next question in this motivator-attractor series is number 6: "What have you liked about your job(s) at DCA?" Continuing on in a consistent vein, 14 of 20 (70%) mentioned the nature of work they were called upon to perform at DCA. Of a total of 20 different factors mentioned by the respondents as things they liked about their jobs at DCA: five (5) of those dealt with the intrinsic nature of the work performed, and those five factors got a total of 27 votes (51% of all votes cast.)

Specifics mentioned as enjoyable about the nature of work included: the opportunity to work with new technologies or at the state-of-the-art; the variety of problems presented for work; generally challenging or exciting work; the broad scope of the taskings; the management or program management challenge; and the chance to work on large systems.

Factors mentioned which were extrinsic to the nature of the work itself were mentioned with a lesser degree of broad general agreement among respondents: 4 of the 20 respondents (20%) mentioned the opportunity to have an

impact, and another 20% mentioned enjoying having a goodly amount of independence in planning and carrying out their assigned responsibilities. Three (15%) mentioned enjoying the people they worked with.

B. A PORTRAIT OF THE IDEAL SUPERVISOR OF ENGINEERS

The next question in the motivator attractor series is number 12: **"What words or phrases would you use to describe an ideal supervisor of engineers?"** The specific words and phrases which respondents used to answer this question are varied, in a word-for-word comparison. However, several parallel ideas or concepts emerge repeatedly.

The most repeated idea is that engineers prefer a supervisor who sets general parameters, or gives broad guidance, and then gives his or her staff considerable latitude and independence in planning for the specifics of the work and in carrying it out. This supervisor generally should be an engineer, and be capable of giving guidance when asked, but need not be well versed in the technical details of the day-to-day goings on: 12 of 20 (60%) put combinations of traits similar to these in their ideal supervisor of engineers. These phrases, taken from the interviewer's hard-written notes, are typical of those used to describe this particular combination of facets of an ideal supervisor: "...one who accepts ideas, and can give direction when needed, but who elsewise leaves one alone." "...one who is supportive and can be decisive, but who leaves room for independence...he must not micromanage." "... a professional with sufficient experience to give guidance when needed." "...he gives broad guidance and allows the engineer a great deal of freedom within those guidelines...he does not micromanage a project, he just sets the stage and gives feedback in the broad sense." "...a pro-active kind

of manager in the sense of expecting from engineers technical innovations in the work they do and giving sufficient latitude to get it done."

Two other significant trends emerged, though neither is as strong as the first. Engineers want their supervisors to have general and interpersonal communications skills. Technical competence alone isn't enough: 9 of the respondents (45%) commented along this line. Several specifically mentioned that an ideal supervisor gives both positive and negative feedback. This group of engineers also looked for a supervisor who was competent, in general, in leadership: 30%.

Finally, 6 of the 20 interviewed (30%) said that problems with their supervisor or manager were one of the primary causes of their decision to leave DCA.

C. EXPECTATIONS OF VERSUS EXPERIENCES AT DCA IN SEVEN KEY AREAS

In question three, respondents were asked to say whether their expectations in coming to DCA were met, were not met, or were exceeded in actuality, for seven key areas. The areas of inquiry and the results are shown in Table 2.

These results add to the growing body of evidence that DCA's big drawing card in the competition for engineering talent is the nature of engineering and technical work that it can offer. The expectations of 85% and 95% of these engineers, respectively, were met or exceeded with regard to the challenge and degree of interest of their work at DCA. These findings are of particular significance. As we saw earlier, As we saw earlier, nature of work is the most critical factor in job satisfaction for this group or engineers. And, in our review of literature earlier in a previous chapter of this study, we saw that such is also the case for engineers and scientists in general

TABLE 2

DEGREE TO WHICH INITIAL JOB EXPECTATIONS WERE MET AT DCA

	LESS THAN EXPECTATIONS	SAME AS EXPECTATIONS	MORE THAN EXPECTATIONS
Challenging Work	15%	55%	30%
Interesting Work	5%	55%	40%
Professional Environment	45%	30%	25%
Chance to Work With Respected Professionals, Colleagues	30%	35%	35%
In Terms of Salary, Benefits	5%	75%	20%
In Terms of Advancement Potential	25%	50%	25%

D. THE PERCEIVED REALITIES OF WORKING WITH DCA SUPERVISORS

Questions 7, 8, 9, 10, 11, and 13 are a group which probe into the engineer's feelings and perceptions about his relationship with his last supervisor at DCA (the supervisor in the job he left), and his thoughts about his supervisor's performance both as a supervisor, and in relation to the oversight of engineering technical matters.

1. Relationships with Supervisors

Question number seven asked respondents, **"In the job you left at DCA, how would you describe your relationship with your immediate supervisor?"** The respondent was offered three response choices, in this instance: a positive/middle choice, "average and acceptable," "something better than that," or "something less than that." The results are shown below:

Grouping these two responses we find that 16 or 80% saw their relationship with their supervisor as average and acceptable or better.

TABLE 3

RATING RELATIONSHIP WITH THE SUPERVISOR

(LESS THAN)	AVERAGE &: ACCEPTABLE	(BETTER THAN)
20%	35%	45%

2. How Well Did Your Supervisor Perform in the Supervisory Roles?

Question 8 asked, "In the job you left at DCA, how would you describe your supervisor's performance as a supervisor?" The respondents were asked to address supervisory performance separately for technical and "all other supervisory dimensions."

TABLE 4

SUPERVISORY PERFORMANCE

	(LESS THAN)	ADEQUATE	(MORE THAN)
TECHNICAL SUPERVISION	25%	55%	20%
OTHER ASPECTS	45%	35%	20%

Seventy-five percent of respondents were satisfied with the technical supervision exercised by the supervisor in the job they left at DCA. Of the 25% who were not satisfied, these comments are representative: the technical work lacked an overall focus; he (supervisor) did not know what was going on; he was a generally competent person, but he was in no way prepared for the job he came to at DCA (speaking of a military supervisor); he was overconservative; I didn't respect him as a person.

Forty-five percent of the respondents expressed disappointment with their supervisor's performance in the

non-technical aspects of supervision. Typical deficiencies cited include included: over-(or micro-)managing; personality problems; "management by exception;" not going to bat for their programs; insensitivity to "people things."

3. What About The Level of Supervision?

In question 9, the engineers were asked, "How would you describe the level of supervision you received?" The interviewer suggested several different responses, in this case, since the exact meaning of the question was not immediately apparent to some. Among the responses the interviewer suggested were: adequate and about right, too close, too loose, inadequate, or "whatever fits."

TABLE 5

THE LEVEL OF SUPERVISION

LESS THAN SATISFACTORY	ADEQUATE AND ABOUT RIGHT
40%	60%

The following are typical comments from those who reported less than satisfactory level of supervision. Supervisor: was an obstructionist; lacked leadership ability, lacked the ability to give any direction; did not know what was going on; controlled so tightly that he stifled initiative; micro-managed.

4. Could the Employee Influence His Supervisor?

Question 10 asked the employee, "How would you describe the level of influence you actually had on the decisions your supervisor made that were actually relevant to your work?

TABLE 6

ABILITY TO INFLUENCE THE SUPERVISOR?

INADEQUATE	ADEQUATE	VERY GOOD/HIGH
20%	15%	65%

5. Relationship With Supervisor and Quitting DCA.

Question 13 asked, "Were matters related to supervision a factor in your leaving DCA?" Six or 30% said that matters related to supervision were a factor in the decision to leave DCA; 70% said that such matters were not a consideration.

6. The Engineer and the Powers That Be

The final question in this group asked, "How would you describe the level of influence you had on the individual who actually had the power to make significant decisions on the nature and course of your work?

TABLE 7

ABILITY TO INFLUENCE THE POWER PERSON?

LITTLE or INADEQUATE	ADEQUATE	VERY GOOD or HIGH
60%	20%	20%

For the first time in this series of questions on supervisory and managerial relationships, the proportion of positive responses (adequate or better) is less than that of the negative responses (inadequate or little.) Since the perception of "having an impact" or making a difference is essential to the job satisfaction of most engineers, according to this research, and according to the literature, it may be quite an important finding if we assume that one takes some degree of the measure of his impact by the measure of his influence on the true decision makers.

TCE MANAGEMENT AND THE QUIT RATE

stion 14 asked respondents, "Were matters related to nand or agency-level leadership a factor in your decision leave DCA?"

TABLE 8

HIGH LEVEL LEADERSHIP INFLUENCE YOUR QUITTING DCA?

	YES	NO
COMMAND	40%	60%
AGENCY	55%	45%

Forty-five percent of respondents had strong dissatisfactions with leadership at the command level. Phrases and as used by more than one of the respondents to describe perceptions of problems at the command level included: r-managed, over-controlled; weak, ineffective; myopic roach, over-conservative style; generally capable, but te inadequate for his particular position.

An even larger group, 55% was seriously dissatisfied n the leadership at the Agency level and specified that ters related to agency-level leadership were directly ated to their decision to leave DCA. Comments and ases used to describe such reasons included: decline of ior civilian technical management influence; the utility the engineering center was taken away; incompetent tech-ally; agency leadership did not trust or respect their engineers; it's a senseless bureaucracy; innate distrust civilians; the Director destabilized civilian morale; the ector does not know the mission; the director is weak; director creates maximum anxiety for civilians; paro-al vision; difficult for a joint agency to take its htful place in the defense community. It is of

-guidance is broad and general and engineers have a great deal of latitude in how they execute their work

-supervisors give feedback, but over-(or micro-) management does not exist

-management is competent and creates a positive, professional engineering environment.

There are natural impediments to this ideal job situation in any large bureaucracy. However, as Peters points out, some very large and very successful companies have overcome shortcomings typically associated with size and the bureaucratic processes and character that can ensue: "The excellent companies have a deeply ingrained philosophy that says, in effect, 'respect the individual,' 'make people winners,' 'let them stand out,' 'treat people as adults.'" [Ref. 5]

It is the purpose of this work only to describe the motivations and aspirations of the engineers who leave DCA and to define the reasons for their decisions to separate from DCA. The next logical step to this research is to explore the creation of a more consistently motivating environment for DCA's engineering staff so that DCA may be on "top of" engineering turnover rather than struggling to keep pace with and understand it.

the negative side for some. It's quite logical because of the high degree or value a sense of accomplishment has to engineers. Also, disillusionment with higher management levels was cited by several as a primary reason for leaving. Given the apparent increase in engineering turnover, it looks as if the drawing cards are either not as strong as they once were, or the demotivators are becoming weightier than the attractor variables in the balance. Data collected in question three, on the degree to which various expectations in coming to DCA were actually met, indicate that the drawing card of nature of work - the most critical of all of the variables - is still strong. However, disappointment with the degree of professionalism in the DCA environment is considerable, as is disappointment with the degree to which one can have an "impact," or "make a difference." It appears that various frustrations associated with the bureaucracy and with the performance of some DCA managers may be tied to the growing feelings among some that the chance of personal accomplishment or impact is blocked, and to negative feelings about the adequacy of the professionalism of the environment.

D. THE IDEAL JOB

The ideal enginering job is one in which:

- work is exciting and challenging
- opportunities to grow as an engineering professional continue
- good work is appreciated and recognized
- achievement of goals and objectives is reasonably feasible

neering manager, then, is called to be sophisticated in the skills and arts particular to high- tech personnel leadership.

B. DCA'S DRAWING CARDS

DCA's top drawing card is the nature of work it can offer the engineer. The opportunity to work on broad-scoped assignments involving very large telecommunications systems, is almost unparalleled in the industry. Such opportunities excite the engineer. He or she is also drawn by the expectation of working with other top-level professionals of broad and diverse talents and skills. The third strong drawing card for DCA is the expectation that the individual will have the opportunity to have a personal impact on some matter of considerable import. And for some years now, these strong drawing cards have captured and held extraordinary engineering talent. But it appears that something is changing.

C. THE NEGATIVES FOR SOME DCA ENGINEERS

When DCA engineers come to believe that they no longer have an impact on something significant or when that work is no longer appreciated; or when the work loses its challenge and the opportunities to grow cease, notions of moving on can set in. The erosion of personal impact and of perceived respect by higher management is a particular liability that DCA has had towards a group of its former management staff. The decline in job challenge and opportunity to grow professionally or technically were stumbling blocks for former employees at every level and length of service. Frustrations with impediments to mission accomplishment associated with bureaucracy in general, or the joint-arena in particular are another factor which can tip the scale to

turnover. In working to retain engineering talent the manager must not only remember his promises to provide the individual with challenging, interesting work and the opportunity for long-term growth on the job, both technically and professionally; but must also:

-provide a range of feedback without appearing to over-manage or to micro-manage

-reward noteworthy performance

-be open and attuned to environmental frustrations that may be reaching a level of significance which could induce looking for other employment

-establish open lines of personal communication with the employee in order to have access to the pulse of work-related frustrations and disappointments

-be ready to work with employees to -devise creative solutions to the problems at hand.

-inspire confidence as a competent professional.

Recruiting is, then, only an initial step in engineering staffing. As Mr. Wortman puts it, "The function of an engineering manager, director of R & D, vice president for engineering - or whatever the manager's title might be - is not to show the creative engineer how to perform his function. It is primarily to create the ambience and the relationship that motivates, stimulates the creative process of the individual who is responsible for the work task... It almost goes without saying that engineers and scientists, especially those identified as creative, must have positive regard for the professional skills and knowledge of their managers in reference (not deference) to the technological areas in which they operate." [Ref. 2 pp. 65-66] The engi-

V. SUMMARY AND CONCLUSIONS

A. ATTEMPT TO ADDRESS THE TOTAL MOTIVATIONS PACKAGE

Several findings may be of particular value to the Defense Communications Agency in its quest to acquire some degree of control over engineering turnover. Of particular note is the finding of this study, and of other studies reviewed in the literature, that looking only to what draws an engineer (what attracts him or her) to a job, or to what one likes about a job, reveals at most only half of his or her motivational structure. Factors which cause an engineer to seek other employment are not limited to the opposite of or negation of the attractor factors, those which drew him or her to the job, although these opposites can have this effect. Rather, a whole set of factors not strongly at play in the recruiting process do come into play when retention is the objective.

The astute manager must attract the engineer to his job vacancy by offering:

-challenging, interesting work

-a professional environment in which to execute the work

-the opportunity for the individual to "make a difference," to "have an impact"

-the vision of the opportunity to grow in technical or professional skills.

At the same time, he must set a plan in motion to keep the engineer satisfied and motivated to remain at the job if the manager is to exercise some degree of control over

we begin to see factors other than nature of work mentioned: frustrations and disillusionment with management; threatened decline in retirement benefits; military-civilian interface problems; the bureaucracy; organizational politics; and perceived parochialism. Unlike the Friedlander and Walton study, however, we also see that the impediment of what were the strong attractor factors , i.e., the challenge and degree of interest of the work, and the opportunity to "have and impact" becomes a negative motivator.

I. WAS THE GRASS IN FACT GREENER?

The last question asked was, "Was your experience in the job you left DCA to go to as positive as you thought it was going to be?" Here are the responses:

NO	YES	EVEN MORE SO
15%	60%	25%

The interviewer was interested in discovering any possible pattern of job discontent among the group of engineers who left DCA. There was no such pattern in evidence: 85% of the respondents answered positively.

-matters related to style or competency level of higher management.

Three respondents mentioned at this point that threatened changes to civil service retirement benefits and policies had tipped the balance for them in a decision process that was already underway. There were many other responses, but no other apparent clustering.

Question 29 asked, **"What is the one primary reason you left DCA?"** Most respondents (55%) were not able to identify one single top reason for leaving, but said that their decision had been a combination of things mentioned in response to the two previous questions. A few could single out one thing that carried more weight than the other factors in their decision: four (20%) found the lack of opportunity to broaden and grow in and of itself sufficient reason to consider leaving the job; 20% left primarily because of problems with the military-civilian interface at the top management levels; one left for reasons of geographic preference.

In the next to the last question, the respondents were asked , **"What one thing could DCA have done that might have influenced you to stay?"** Forty-five percent (45%) of respondents answered either "nothing," 'there was no one thing," or "nothing, it was too late." Two answers had two respondents each: "challenge my abilities;" and, "provide me the opportunity to grow professionally." there was no other clear clustering for this question. For a look at the answers, see Appendix B.

"The predominant negative motivation of the scientist is away from environmental dissatisfiers rather than away from work process dissatisfiers," say Friedlander and Walton [Ref. 12: p. 204]. The findings in this study are in general agreement. When we look at "negative motivators,"

-discontent with either the management style or/and the level of competence of higher management (30%)

-problems related to military-civilian interface in general, and at the top management levels in particular (20%)

The next highest group of "vote-getters" were:

-lack of or a decline in personal influence and impact (15%)

-problems (political and practical) associated with being a "joint-agency" (15%)

-the lack of a continuing opportunity to broaden and grow professionally (15%)

-lack of professional and technical competence among colleagues and/ or managers (15%)

-being underutilized and underchallenged (15%)

-difficulty in obtaining resources necessary to get the job done (10%)

-too much engineering work contracted out (10%)

-lack of advancement opportunity (10%)

-viewing the comptroller operation as "obstructionist" in nature (10%)

More detail on the nature of these responses can be found at Appendix B.

The next question asked the respondents, "Which, if any, of these frustrations were primary factors in your decision to leave?" The top reasons were few in number:

-lack of opportunity to broaden and grow

-the job was no longer challenging

TABLE 12

HOW IMPORTANT IS RECOGNITION?

	LOW	MEDIUM	HIGH
INFORMAL RECOGNITION	1 (5%)	6 (30%)	13 (65%)
FORMAL RECOGNITION	2 (10%)	11 (55%)	7 (35%)

bestseller, In Search of Excellence [Ref. 5: p. 25]. The scientist or engineer needs to know that his or her work is of significance and is appreciated. Here we see that 95% of respondents see informal recognition as of medium or high importance to them, with 90% so voting for formal recognition as well. It seems only common sense that this would be so among a group whose motivations are largely in the work itself, and in the perception of having a personal impact in some matter of significance would respond this way. As Peters and Waterman say, "respect the individual... make people winners... let them stand out... treat people as adults." [Ref. 5: p. 277]

K. THE MOST FRUSTRATING THINGS ON THE JOB AT DCA

The next three questions probed for the heart of the reasons the respondents left DCA and asked them to put some kind of a ranking on them. Question 26 asked, **"Name the three things about working at your job at DCA that most frustrated you?"** The responses, on a word-for-word basis were varied. However, as in previous cases, trends did emerge. The top six "vote-getters" in this category were:

- -organizational politics and rivalries; the overall lack of a team view of of things, or conversely, parochial vision (45%)
- -general frustrations associated with the bureaucratic processes (40%)

Walton [Ref. 12: pp. 39-40] whose research demonstrated that the "attractor" variables, those which draw an engineer to work and contribute to a desire to remain, are largely intrinsic to the nature of the work itself. Here we see that pay was a primary reason to leave DCA for only two of the 20 interviewees. Money, then, is not a major reason behind DCA's loss of engineers.

J. RECOGNITION ON-THE-JOB

Questions 24 and 25 addressed the issues around recognition on the job. Question 24 asked, "Were you adequately, fairly recognized at DCA for the work that you did there?" Respondents were asked to evaluate the question on two levels: informal recognition (referring to ongoing recognition through normal interaction with supervisors and managers; and formal recognition, referring to awards received:

TABLE 11
WAS RECOGNITION ADEQUATE?

	YES (ADEQUATE)	NO
INFORMAL RECOGNITION	65%	35%
FORMAL RECOGNITION	75%	25%

When asked, "How important is recognition on-the-job to you?" respondents again were asked to rate formal and informal recognition separately, and to choose either high, medium or low as their response. The results were as follows:

Recognition is often cited in the literature as important to the scientist or engineer. Quite recently, Peters and Waterman have highlighted its significance in the

for that work in the industry in general; at whether cr not in dcing what they were doing at DCA they were working at thier full earning pctential as an engineer, given their present level of experience or education; and at whether or not matters related to pay were a factor in their decision to leave DCA.

In answer to the question, "Was your pay level at DCA competitive with what others in your field at your level and jok-type were being paid?"

-15 or 75% said "nc," pay was not competitive.

-5 (25%) said "yes."

In answer to the related question, "Given your experience and education, how was your salary at DCA relative to your earning potential at that time?"

-17 (85%) fcund it low

-2 (10%) said that it was just about right,

-1 (5%) said that he was working above his competitive earning potential.

Question 23 asked, "Were salary , or salary and benefits a factor in your decision to leave DCA?": 40% answered "yes," salary and benefits were in fact a consideratich in the decision to leave DCA. Of those eight engineers:

-2 saw it as a primary factor;
-6 saw it as a secondary factor;
-2 saw it as a minor consideration.

The majority of the group expressed the idea that salary alone was not typically adequate reason to leave a job. Several said that salary did not become a consideration until at all until they began looking for another job. These findings are in line with those of Friedlander and

decisicn to leave DCA. For six of those, it was the primary reason for leaving. Several in this group who had answered that professional development at DCA was more than satisfactory explained that they had reaced a point in the jobs they left at DCA where they could no longer grow professionally or technically. Several spoke of having reached a "dead-end." As was the case when speaking of advancement earlier, "dead-end" usually did not mean monetarily or positionally alone. Professional or technical advancement held more weight for most.

H. SPACE AND EQUIPMENT

Questions 19 and 20 took a look at the relative importance of workspace and equipment to the engineer, and his level of satisfaction with those at DCA. Question 19 asked, "Were your office space and work equipment at DCA satisfactory?" 85% of respondents found their workspace at DCA adequate. All respondents (100%) were satisfied with the equipment available to work with.

Question 20 asked, "Is workspace in general important enough to be a primary or secondary factor in a decision to leave a job? Eighty-five percent (85%) said "no." This is not surprising in the light of the clear motivations of this group of engineers which revolve around the nature and content of work, and importance of personal contribution. However, two engineers did remark that although workspace was not a factor in their decision to leave DCA, it was a consideration in selecting their new job.

I. PAY LEVEL AND LEVEL OF EARNING POTENTIAL REALIZED

Questions 21 - 23 took a look at the engineers' perceptions of the degree to which their pay at DCA for the job they were doing was competitive with what was being offered

A large number, 80%, were also at the least satisfied with relationships between interdependent groups they had worked with. Several did comment, however, that interdependent group relationships above the working group level were not as good, and cited things such as parochialism, and "politics" to describe the problem between groups at the higher levels.

Question 16 asked, **"Did relationship with colleagues play a part in your decision to leave DCA?":** 90% said "no."

C. HOW ABOUT YOUR PROFESSIONAL DEVELOPMENT?

Questions 17 and 18 were designed to gain insight into the engineers ideas and feelings about their own professional development during their stay at DCA, and to determine if matters related to professional development were a factor in their decisions to leave.

Question 17 asked, **"How would you describe your professional development during your stay at DCA?"** The respondents were asked to select from among three answers: satisfactory; something more than that; or something less than that.

TABLE 10

EVALUATE YOUR PROFESSIONAL DEVELOPMENT

	(LESS THAN)	SATISFACTORY	(MORE THAN)
PROFESSIONAL DEVELOPMENT	20%	25%	55%

When asked, **"Were matters related to professional development a factor in your decision to leave DCA?"** the answers looked a little different. Eight or 40% said "yes" matters related to professional development were related to the

importance to note here, that dissatisfaction with management at the highest levels of the Agency were cited a the primary reason for leaving by several of the most senior former staff among the group of interviewees.

F. PEER RELATIONSHIPS

Questions 15 and 16 looked at how these engineers felt about thier relationships with their colleagues at DCA, and at whether or not related matters were a factor in any decision to leave DCA. Question 15 asked, "How would you describe your relationship with DCA Colleagues?" The respondents were asked to answer regarding two definitions of colleagues: the immediate work group, and intra agency or DoD groups (interdependent groups with whom cooperative work efforts were required.) Respondents were asked to categorize their responses as average and acceptable, or as something better than that or less than that.

TABLE 9
RELATIONSHIP WITH COLLEAGUES

	(LESS THAN)	ADEQUATE/GOOD	(MORE THAN)
IMMEDIATE GROUP	5%	5%	90%
INTERDEPENDENT GROUPS	20%	35%	45%

As the results show, peer relationships in the immediate work group are a "plus" at DCA. Only one of the twenty respondents was not satisfied on this count. In fact, 90% of the respondents described peer relationships in their immediate work group with phrases such as, "excellent" and "very cooperative."

APPENDIX A
INTERVIEWER'S GUIDE

QUESTION #1: WHAT DREW YOU TO DCA? What things did you expect to like about DCA itself and the job?

QUESTION #2: DID YOU ANTICIPATE ANY DISLIKES BEFORE YOUR ARRIVAL?

QUESTION #3: HOW DID YOUR EXPERIENCE AT DCA MATCH YOUR EXPECTATIONS? FOR EACH OF THE ITEMS LISTED BELOW?

	1 less than expectations	2 same as	3 more than
challenging work	---	---	---
interesting work	---	---	---
professional environment	---	---	---
chance to work with respected professionals, colleagues	---	---	---
opportunity to grow in particular engineering discipline	---	---	---
in terms of			
salary and benefits	---	---	---
advancement potential	---	---	---

QUESTION #4:. IN GENERAL, WHAT ELEMENTS WOULD BE FOUND IN A SATISFYING JOB FOR YOU? (Note: give no hints.)

QUESTION #5:. OF THOSE ELEMENTS FOUND IN A SATISFYING JOB FOR YOU, WHICH ARE #'s ONE and TWO IN IMPORTANCE TO YOU?

QUESTION #6: WHAT HAVE YOU LIKED ABOUT YOUR JOB(S) AT DCA?

QUESTION #7: IN THE JOB YOU LEFT AT DCA, HOW WOULD YOU DESCRIBE YOUR RELATIONSHIP WITH YOUR IMMEDIATE SUPERVISOR?

QUESTION # 8: IN THE JOB YOU LEFT AT DCA, HOW WOULD YOU DESCRIBE YOUR SUPERVISOR'S PERFORMANCE AS A SUPERVISOR?

technical supervision:

administrative supervision:

QUESTION #9: HOW WOULD YOU DESCRIBE THE LEVEL OF SUPERVISION YOU RECEIVED?

QUESTION #10: HOW WOULD YOU DESCRIBE THE LEVEL OF INFLUENCE YOU ACTUALLY ON THE DECISIONS YOUR SUPERVISOR MADE THAT WERE ACTUALLY RELEVANT TO YOUR WORK?

QUESTION #11. HOW WOULD YOU DESCRIBE THE LEVEL OF INFLUENCE YOU HAD ON THE INDIVIDUAL WHO ACTUALLY HAD THE POWER TO MAKE SIGNIFICANT DECISIONS ON THE NATURE AND COURSE OF YOUR WORK? WHO WAS THAT (POSITION)?

QUESTION #12: WHAT WORDS OR PHRASES WOULD YOU USE TO DESCRIBE AN IDEAL SUPERVISOR OF ENGINEERS?

QUESTION #13: WERE MATTERS RELATED TO SUPERVISION A FACTOR IN YOUR LEAVING DCA? HOW?

QUESTION #14: WERE MATTERS RELATED TO COMMAND OR AGENCY LEADERSHIP A FACTOR IN YOUR DECISION TO LEAVE DCA?

yes _____ command _____ agency _____

no _____

IF YES. WAS IT A PRIMARY OR SECONDARY FACTOR?

primary _____ secondary _____

QUESTION #15: HOW WOULD YOU DESCRIBE YOUR RELATIONSHIP WITH DCA COLLEAGUES?

QUESTION# 16: DID RELATIONSHIP WITH COLLEAGUES PLAY A PART IN YOUR DECISION TO LEAVE DCA? HOW?

yes _____

no _____

IF YES, WAS IT A PRIMARY OR SECONDARY FACTOR?

primary _____

secondary _____

QUESTION # 17: HOW WOULD YOU DESCRIBE YOUR PROFESSIONAL DEVELOPMENT DURING YOUR STAY AT DCA?

QUESTION #18: WAS THIS A FACTOR IN YOUR LEAVING DCA?

yes _____ no _____

IF YES, WAS IT

primary _____

secondary _____

QUESTION #19: WERE YOUR OFFICE SPACE AND WORK EQUIPMENT AT DCA SATISFACTORY?

space yes _____ no _____

equipment yes _____ no _____

IF NO, WAS WORKSPACE OR EQUIPMENT A FACTOR IN YOUR DECISION TO LEAVE DCA?

yes _____ workspace _____ equipment _____

no _____

QUESTION #20: IS WORKSPACE IMPORTANT ENOUGH TO YOU TO BE A PRIMARY OR SECONDARY FACTOR IN A DECISION TO LEAVE A JOB?

QUESTION #21: WAS YOUR PAY LEVEL AT DCA COMPETITIVE WITH WHAT OTHERS IN YOUR FIELD AT YOUR LEVEL AND JOB TYPE WERE BEING PAID?

QUESTION # 22: GIVEN YOUR EXPERIENCE AND EDUCATION, HOW WAS YOUR SALARY AT DCA RELATIVE TO YOUR EARNING POTENTIAL AT THAT TIME?

QUESTION # 23: WERE SALARY, OR SALARY AND BENEFITS A FACTOR IN YOUR DECISION TO LEAVE DCA?

yes _____ no _____

IF YES, WAS IT A PRIMARY OR SECONDARY FACTOR?

primary _____

secondary _____

QUESTION #24: WERE YOU ADEQUATELY (FAIRLY) RECOGNIZED AT DCA FOR TEEWORK YOU DID THERE?

informal recognition from supervisor, e.g., praise, mentioning your work to others;

adequate (fair) _____ inadequate (unfair)

_____

formal recognition (awards):

adequate (fair) _____ inadequate (unfair)

_____

QUESTION #25: HOW IMPORTANT IS RECOGNITION ON THE JOB TO YOU?

informal recognition low _____ medium _____ high _____

formal recognition low _____ medium _____ high _____

QUESTION # 26: NAME THE THREE THINGS ABOUT WORKING AT YOUR JOB AT DCA THAT MOST FRUSTRATED YOU?

QUESTION # 27: WHICH, IF ANY, WERE PRIMARY FACTORS IN YOUR DECISION TO LEAVE?

QUESTION # 28: WHAT IS THE ONE, PRIMARY REASON YOU LEFT DCA?

QUESTION # 29: WHAT ONE THING COULD DCA HAVE DONE THAT MIGHT HAVE INFLUENCED YOU TO STAY?

QUESTION #30: HAS YOUR EXPERIENCE IN YOUR NEW POSITION BEEN AS POSITIVE AS YOU EXPECTED IT WOULD BE WHEN YOU LEFT DCA?

APPENDIX B
INTERVIEW RESPONSE LISTINGS

Listed by question here are abbreviated responses for questions for which only trends were presented in Chapter 4. The number of times a particular response was given is found in Chapter 4. Frequencies are not repeated here nor are responses listed in order of magnitude. Rather, the purpose of this appendix is to allow readers to see all responses to questions including those which are not otherwise reflected in the body of this research because they occur too infrequently to constitute a trend of any significance. The sequence in which the responses are presented is random.

Question 1: What drew you to DCA?

- looking for a job - right type of work for my background
- interested in DoD data communications networks
- work offered was technically and professionally challenging
- work presented "opportunity to make a difference"
- worldwide telecommunications operation that was moving ahead with a total systems approach to telecommunications
- program management challenge
- opportunity to grow as a manager
- interesting work; knew agency contractor who described operation to him
- DCA needed help and I thought that I could help them, but if job had not been in Reston I would not have come
- patriotism; it was wartime and DCA needed people with my particular knowledge and skills
- opportunity to gain broader technical experience in

combination with a promotion to come
-liked the work and the people; had positive experience in previous summer job there
-job description given presented broad responsibilities; other offers were much more narrow
-was dissatisfied in job I was in and someone at DCA asked me for a a SF 171
-the name "engineering center" drew me; I liked the idea of a technical arm
-there was a professional atmosphere in government back then; had worked as a DCA SETA contractor; government
was more ethical then, and treated its employees better
-was getting out of the service; my boss know about DCA and asked for a resume
-came to DCA by transfer of function when DCA was formed
-for new opportunities in an expanding field
-admired General _____ who was the Director of operations then
-opportunity to work on new command and control mission in combination with a significant salary increase
-Admired General _____, the Director of DCA

Question 4: " In general, what elements would be found in a satisfying job for you?

-significant responsibilities plus being given the resources and freedom to be able to run with those
-being provided the proper support in terms of people and tools
-good management - the kind you can go to and receive support from, and the kind you can understand so that you can support him
-technical challenge
-technical professionalsim, from both the standpoints

of the technical disciplines and the integrity of the people in the organization
-collegial atmosphere
-the opportunity to have an impact
-the opportunity to be more of a general manager in order to be able to influence the ability to do a good technical job from all aspects
-the opportunity to grow as a professional manager
-the opportunity for advancement
-the opportunity to work a the leading edge of of technology
-a good relationship with top management
-good support and support services, e.g. computer terminals and secretarial, , and from personnel, supply, etc.
-a sense of accomplishment - accomplishment of something that counts
-a place where people are treated as human beings, where people care for you, where you are part of a caring team
-a job where you can use engineering principles to actually implement a system - going beyond the conceptual or architectural phase to bringing it to fruition
-an environment where one has respect for colleagues and where one is respected by them
-the opportunity to make a meaningful technical contribution to improve the way the DoD does its business
-an situation where the skills of respected colleagues match the demands of the environment
-where there is a technically competent, synergistic group of colleagues
-a degree of freedom to pursue things
-an atmosphere where you can get things done

-the opportunity to grow technically
-the work must be necessary, important work
-if I have time to sit and read the newspaper, then the job is not for me
-if I do the job right, I expect to be rewarded for it; at the same time, if I don't, I expect a slap on the wrist
-work that is technically challenging
-work that is interesting to be involved with
-a professional engineering environment
-recognition
-financial reward
-proper degree of professional respect
-number on is challenging work
-reasonable salary and benefits
-chance to work fairly independently
-environment where there is a good buffer zone - where I don't have to deal with administrative groups that think they run the organization
-an organization where people know their place, i.e., "contract-types"
-the opportunity to make a contribution
-where my work is appreciated and accepted
-where the action is
-work has to be exciting in the sense that it is an important public service, or is in the national interest
-where one is in a position to explore to the fullest his strengths in making it all happen
-stimulating, challenging work
-adequate compensation

Question 6: "What have you liked about your jobs at DCA?"

-involved in a new technical development while there

-opportunity to keep abreast of new technologies and to work at the state-of-the-art in data communications
-opportunity to create a professional atmosphere and to bring in competent personnel to apply to a challenging problem
-work was challenging and interesting
-variety of problems presented
-ability to deal across different military boundaries and CSD
-tasks very broad-scoped
-able to work where very little guidance on how to get the job done was given
-high level visibility and contacts
-lots of resources, reasonable funding and good sponsorship in OSD
-I had more latitude than most
-over the time I was there I influenced a whole lot of things in a positive way - got them organized
-building the systems in Vietman and Thiland was fun and satisfying as was subsequent work on links in -1 other countries
-work was interesting, challenging and varied, technically speaking
-the technical aspects: doing engineering analysis and developing architectures
-the people
-the general type of work - defense work is fulfilling
-the office I was in was altogether a nice atmosphere to work in
-I was totally in charge of what I was doing; it was either make it or break it on my own
-my original group was a great bunch of people to work with;the office management and staff were professionals from all standpoints; the group was closely knit

-the educational opportunities
-the technical library
-good spirit at special parties
-the technical challenge
-great independence in how I did my job, because management was so non-existent that you could grab the bull by the horns and run with it
-was able to get involved in the forefront of technology
-good people, interesting and friendly
-good working atmosphere in my division
-work was always exciting and technically challenging
-had the opportunity to get out and visit places and see the results of my work
-opportunity to be involved in a lot of system design in the formulation stages
-opportunity to be creative and have an impact
-wild and exciting work on the new worldwide command and control system
-wide variety of interesting problems from both the technical and managerial standpoints
-the opportunity to make something happen in the system

Question 12: "What words or phrases would you use to describe an ideal supervisor of engineers?" (Note: traits are clustered here as they were spoken by individual respondents)

-administrative abilities; the insight to understand the abilities of his people and to use those to provide a total capability from the way that he works his people together; one who accepts ideas and one who is able to provide ideas when necessary - when direction is is needed, but who elsewise leaves one alone; one who helps with problems, but who does not manage or

supervise me; one who gets involved when you need him to get or do what you cannot get or do

-the most effective kind is one who has insight to comprehend the broad thrust of what's being presented and provide guidance along those lines; and one who has a degree of rational integrity regardless of personal traits - the right technical decision comes out, given any real constraints; and one who gives you the impression that what you say will have an impact

-supportive; decisive, provides leadership but is not a micromanager; some technical competence and some ability to manage - the latter is more important; one who leaves room for independence - gives broad guidelines, not "how-to's"

-one who is technically competent; who is undestanding and compassionate; has good interpersonal skills; has good business sense regarding his environment

-a professional with sufficient experience to give give guidance when needed; I believe you determine what the problem is and give guidance at the beginning of a project, versus telling someone that they did it wrong at the end - the principal management style at DCA is "here's a job to do - go do it - I'll tell you whether or not you did it right when you get it done

-one who shows respect for an a measure of trust in his engineers, both as people and professionals

-one who gives broad technical guidance and allows the engineer a high degree of freedom within those guidelines; he must not micromanage, but just set the stage and give feedback in the broad sense

-he or she is technically competent; experienced; a good decision maker; backs up his employees; a good leader in general

-one who knows the strengths and weaknesses of the

engineers, how far he can let each person make decisions on his own, and to that limit he lets individuals make decisions, with guidance as necessary

-a leader, not just one who reacts; one who lets his gc tc the extent of their capabilities, and provides what assistance and encouragement he can to that end

-an engineer who knows how to write and talk - not the classic engineer who can't communicate his ideas tc anyone; he has some degree of management training; cr, cne who is nct an engineer but who has management and verbal skills

-one who gives and receives feedback; who understands the job his people are doing and can guide his people through - though he does not need detailed technical expertise; he backs up his people and know how tc give negative feedback

-one who is an intellect - not necessarily an engineer, but cne with enough knowledge to understand what his engineers tell him; he should be smarter than his staff - knowing the parameters, various aspects and ramifications of things

-one who has an intellectual affinity with the minds of engineers; a pro-active kind of manager in the sense of expecting technical innovations from his engineers and giving them sufficient latitude to get it done; one who gives recognition and acknowledgement when someone has performed well; one who rewards or prods as is appropriate

-one who has an understanding of technical work, though not necessarily detailed, but enough to render judgements; one who understands what motivates engineers; a good leader

Question 14: "Were matters related to command level (00)or agency level leadership a factor in your decision to leave DCA?"

COMMAND-LEVEL RESPONSES

- -yes - it was overmanaged; we did not have the freedom to do things - it turned out that you needed 150 signatures to get an action released, even just to send a message; and it was hard to make the top levels understand what we were doing - and many times they did not even need to know as we were just conveying information, i.e. facts, back and forth; but everything had a huge review and approval procedure before it got out
- -the command managers were not the technical management equals of the senior civilians, although they were good managers in general; and there was an unfortunate decline of senior civilian technical influence
- -decisions were made by the environment by default on management's part; it was a crisis/reaction mode of management
- -no, I moved because of geographic preference; however, if that preference had not been there, it could have been a factor; the leader was not a technical person there was zero there; and he was an obstructionist; he meddled inthe obscure details of travel or in the details of a particular training course
- -the leader was smart and intimidating - there would be periodic screaming and everybody would just react to it
- -leadership was very weak; there really wasn't any leadership; the leader was very belligerent; he had a degree of charisma, and intuitively jumped at the right answers; he turned people off; his attention

span was very short, and he had strong opinions
-there was a conservative style; generally capable military people came but they were not prepared for their jobs - their approach was myopic

AGENCY-LEVEL RESPONSES

-I had a growing sense that the military element- in its less good aspects - was dominant; the engineering operation was debilitated; it wasn't like this in earlier times
-the top level dictates the whole tenor of the agency - there was very little leadership, and little sensitivity to people and human issues
-the director made it clear that he didn't have much use or regard for civilians; the engineering environment deteriorated as did the ability to to accomplish significant work; the director didn't understand what DCA's real mission is; there's too much military management at DCA - engineers are seen as meat to be maneuvered
-The director almost automatically rejected the advice of his own engineers; he preferred the opinions of outsiders
-they were slow to move on things; it was a senseless bureaucracy
-director has an innate distrust of civilian employees; he has destabilized civilian morale; he is naive about the business of the agency; an overall weak director
-its difficult for a joint agency to take its rightful place in the defense community - turf business

LIST OF REFERENCES

1. Lippitt, Ronald and Watson, Jeanne and Westley, Bruce, The Dynamics of Planned Change, Harcourt, Brace and World, Inc., 1958.

2. Wortman, Leon Effective Management for Engineers and Scientists, John Wiley and Sons, 1981.

3. Haga, William James and Acocella, Nicholas, Haga's Law William Morrow & Co., 1980.

4. Pelz, Donald C. and Andrews, Frank M. Scientists in Organizations: Productive Climates for Research and Development, revised ed., University of Michigan, Ann Arbor, 1976.

5. Peters, Thomas J. and Waterman, Robert H., Jr. In Search of Excellence Warner Books, 1981.

6. Vetter, Betty M. Supply and Demand for Scientists and Engineers Scientific Manpower Commission, Jan. 1982

7. U.S. National Science Foundation, Projections of Science and Engineering Doctorate Supply and Utilization 1980 and 1985 NSF75-301, Feb. 1975

8. Gruber, Howard E., Terrell, Glennand Wertheimer, Michael, eds., Contemporary Approaches to Creative Thinking, Atherton Press, NY 1962

9. Ludington, Carol, ed., Creativity and Conformity A Problem for Organizations, Foundation for Research on Human Behavior, Edwards Brothers, Inc., Ann Arbor, 1958.

10. U.S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook, Bulletin 2200, Apr, 1982, 1983 - 1983 edition.

11. Babco, Eleanor L., Salaries of Scientists, Engineers and Technicians, Scientific Manpower Commission, Nov 1983.

12. Friedlander, Frank and Walton, Eugene "Positive and Negative Motivations toward Work" Administrative Science Quarterly, Vol 9, Je 1964 - Mar 1965, pp. 194-207.

13. Schmidt, D.L., Creativity in Industrial Engineering Rand Corporation, March, 1971.

14. French, Earl E., "Perspective: The Motivation of Scientists and Engineers," Academy of Management Journal, Vol. 9, No. 2, Jun 1966 pp. 152 - 156.

15. Khan, R.L., "Review of the Motivation to Work," Contemporary Psychology, 6, (1961), pp.9 -10.

16. Roe, Anne, The Making of a Scientist Dod, Mead; NY, 1953, p.135.

17. Manners, George E and Steiger, Joseph A. and Zimmerer, Thomas W., "Motivating Your R & D Staff," Research Management, Vol xxvi, no. 5, Sept - Oct., 1983.

18. McGregor, Douglas Murray, "The Human Side of Enterprise," The Management Review, Nov. 1957.

19. Peterfreund, Stanley, "The Challenge of the New Breed," Michigan Business Review, Vol 26, No 1, Jan 1974.

20. Harris, Reuben T. and Eoyang, Carson K., A Typology of Organizational Commitment, Working Paper, Alfred P. Sloan School of Management, Massachusetts Institute Of Technology, WP#957-77, Oct. 1977.

21. Steers, Richard M., "Antecedents and Outcomes of Organizational Commitment," Administrative Science Quarterly, Vol 22, Mar 1977.

22. Alexander, Kenneth O., "Scientists, Engineers and the Organization of Work," American Journal of Economics and Sociology, Vol 40, N 1, Jan 1981.

23. Thamhain, Hans J., "Managing Engineers Effectively," IEEE Transactions on Engineering Management," Vol EM-30, N 4, Nov 1983.

24. Landis, Fred and Svestka, Joseph A., The Demand for Engineers - Projections Through 1987," Management Science, Vol 29, N 4, Apr 1983.

25. Carey, Max L., "Occupational Employment Growth Through 1990," Monthly Labor Review, August, 1981.

26. Byron, William J., S.J., "Report on Campus Role in Science and Education Given to Congress," Higher Education and National Affairs, vol 32, no 1, January, 1983.

BIBLIOGRAPHY

Argyris, Chris, "Personality and Organization Theory Revisited," Administrative Science Quarterly, Vol 18, 1973.

Eschenfelder, A.H., "Creating an Environment for Creativity," Research Management, Vol xi. No r, Mar, 1968.

Feinberg, M.R., "Fourteen Suggestions for Maraging Scientific Creativity," Research Management, Vol xi, No 2, Mar 1968.

Fraenkel, Stephen J., How Not To Succeed as a Research Manaer," Research Maragement, Vol xxiii, No 3, May 1980.

Mankoff, Albert, "Values - Not Attitudes - Are the Real Key to Motivation," Management Review, Dec 1974.

Schainblatt, Alfred H., "How Companies Measure the Productivity of Engineers and Scientists," Research Management, Vol xxv, No 3, May, 1982.

Scrivener, Robert C., "Industrial Innovation in Canada," Research Management, Vol xxiii, No 3, May, 1980.

Sharwell, Willaiam G., "A Perscription for Innovation," Research Management, Vol xi, No 4, Mar 1960.

Shipira, Reuvin and Globerson, Schlomo, "Incentive Plan for R & D Workers," Research Management, Vol xxiv, No 5, Sept - Oct, 1983.

Silverman, Gerald G., Attitude of Research and Development Professional Federal Employees Toward Value Systems and Operative Goals: A Study of Scientists, Engineers and Managers at a Federal Installation, a research paper presented to the Department of Advanced Programs, the University of Oklahoma, January, 1977.

Stookey, S.D., "The Pioneering Researcher and the Corporation," Research Management, Vol xxvi, No 5, Sept - Oct. 1983.

Tannenbaum, Robert and Schmidt, Warren, "How to Choose a Leadership Pattern," Harvard Business Review, Mar - Apr, 1958.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93943	2
3.	Department Chairman, Code 54 Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
4.	Professor Reuben T. Harris, Code 54HE Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	2
5.	Professor Roger Evered, Code 54EV Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
6.	Ms. Colleen M. Sherman 2311 Pimmit Dr., Apt. 819 Falls Church, Va. 22043	2
7.	Mr. Dale Starnes Deputy Director for Personnel and Administration Defense Communications Agency, Code 300 Washington, D.C. 20305	1
8.	Mr. James Lewis Assistant Deputy Director for Civilian Personnel Defense Communications Agency. Code 306 Washington, D.C. 20305	1
9.	Director, Leadership & Command Effectiveness Division (NMPC-62) Human Resource Management Department Naval Military Personnel Command Washington, D.C. 20370	1
10.	Director, Human Resources Management Division (OP-15) Deputy Chief of Naval Operations (Manpower, Personnel & Training) Washington, D.C. 20370	1
11.	Commanding Officer Human Resource Management School Naval Air Station Memphis Millington, Tennessee 38054	1
12.	Commanding Officer Organizational Effectiveness Center NAS Alameda Alameda, California 94501	1

13. Commanding Officer 1
Organizational Effectiveness Center Norfolk
5621-23 Tidewater Drive
Norfolk, Virginia 23509

14. Commanding Officer 1
Organizational Effectiveness Center Pearl Harbor
Pearl Harbor, Hawaii 96860

15. Commanding Officer 1
Organizational Effectiveness Center San Diego
Naval Training Center, Building 304
San Diego, California 92133

16. Commanding Officer 1
Organizational Effectiveness Center Washington
Commonwealth Building, Room 1144
1300 Wilson Blvd.
Arlington, Virginia 22209

17. Commander 1
Organizational Effectiveness System Atlantic
5621-21 Tidewater Drive
Norfolk, Virginia 23509

18. Commander 1
Organizational Effectiveness System Pacific
P. O. Box 72
Naval Station
Pearl Harbor, Hawaii 96860

19. Commander 1
Organizational Effectiveness System Europe
P. O. Box 23
FPO
New York, New York 09510

20. Commanding Officer 1
Organizational Effectiveness Center Charleston
Naval Base, Building NH-46
Charleston, South Carolina 29408

21. Commanding Officer 1
Organizational Effectiveness Center Mayport
Naval Station
Mayport, Florida 32228

22. Commanding Officer 1
Organizational Effectiveness Center Naples
P. O. Box 3
FPO
New York, New York 09521

23. Commanding Officer 1
Organizational Effectiveness Center Rota
U. S. Naval Station Rota, Spain
Box 41
FPO
New York, New York 09540

24. Commanding Officer 1
Organizational Effectiveness Center Subic Bay
P. O. Box 60
FPO
San Francisco, California 96651

25. Commanding Officer 1
Organizational Effectiveness Center
Whidbey Island

Naval Air Station Whidbey Island
Oak Harbor, Washington 98278

26. Commanding Officer 1
Organizational Effectiveness Center Yokosuka
P. O. Box 4
FPO
Seattle, Washington 98762

END

FILMED

4-85

DTIC